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T.P.

IN THE UNITED STATES PATENT  
AND TRADEMARK OFFICE

In Re the Patent Application of: Dennis J. Newland  
For: Self Guyed Structures  
Serial Number: 09/895,763  
Filing Date: June 28, 2001  
TC/A.U.: 3635  
Examiner: Chi Q. Nguyen

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**APPELLANT'S BRIEF PURSUANT TO 37 C.F.R. 1.192**

On July 9, 2003, Applicant/Appellant, Denny J. Newland, appealed from the final rejection of claims 15-55 set forth by the Office on April 9, 2003. Claims 1- 14 were cancelled and claims 15-55 added by Applicant on December 2, 2002 in response to a first office action mailed August 2, 2002, said first office action set forth after a June 28, 2001 filing of a *pro-se* non-provisional application. What follows is Appellant's appeal brief as required by 37 C.F.R. 1.192.

**I. Real Party in Interest**

The real party in interest in this appeal is Dennis J. Newland, as identified above as the sole inventor. There is no assignee of this invention.

**II. Related Appeals and Interferences**

No other appeals or interferences are known to Appellant or Appellant's legal representatives which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**III. Status of Claims**

On December 2, 2002, claims 1-14 were cancelled from the case and claims 15-55 were added to the case, all in response to a first office action. Claims 15-55 have

received a final rejection, mailed April 9, 2003. Since this final rejection (in an amendment filed with the Appellant's Brief) claims 15-19 and 39-42 have been cancelled from the case in order to simplify the appeal and remove issues from appeal.

#### **IV. Status of Amendments**

An amendment to the claims under 37 C.F.R. 1.116 is filed with this Appellant's Brief in a separate paper. The amendment merely cancels claims 15-19 and 39-42 in order to remove issues from appeal, and amends claims 53, 54 and 55 in order to remove from dependent claims 53, 54 and 55 a reference to base claims that have been cancelled herein. Thus, the amendment conforms with the requirements and 37 C.F.R. 1.116. Claims 20-38 and 43-55 remain in the case and are presented in the Appendix of this brief in clean form.

#### **V. Summary of Invention**

The inventive technology concerns structures made from compression members and tension members that are in some manner in contact therewith (e.g., via attachment), where the compression members and/or the tension members and/or the tension member attachment sites are arranged in novel configurations that effect functional benefits and advantages over the prior art. Overall, general advantages of these structures as compared with structures of the prior art include an increase in structure material efficiency, and increase in structure strength, a decrease in structure weight, and an enablement or facilitation of the construction of modular, composite structures. The novel configurations include:

- compression members that are situated on:
  - a) "a first" and a "second hyperboloid" (claims 23, 28, 49-52)
    - see Figures 2D and 6B
    - see paragraphs 0027 and 0035 of the publication of the instant application (publication US 2002/0002807)
  - b) "first" and "second hyperbolic paraboloid" surfaces (claims 35-38)
    - see Figures 4A and 4B
    - see paragraphs 0030, 0031 and 0045 of the publication of the instant application (publication US 2002/0002807)
  - c) "the surfaces of two different planes that intersect one another", and where there are "at least four compression members" situated on these surfaces (claims 31-34)

- see Figures 3A and 3B
- see paragraphs 0028, 0029 and 0044 of the publication of the instant application (publication US 2002/0002807)
- tension members arranged in a:
  - d) “radial configuration” (claims 20-23, 29, 33, 37, 45, 47, 51)
    - see Figure 2A (compare with the “circumferential configuration of Figure 1A); see also, Figures 2C, 2D, 3A, 4A and 6C)
    - see paragraphs 0024, 0036 and 0050 of the publication of the instant application (publication US 2002/0002807)
  - e) “internal configuration” (claims 24-28, 30, 32, 36, 44, 48, 50)
    - see Figure 2B (and also, Figure 3B)
    - see paragraphs 0025, 0029 and 0051 of the publication of the instant application (publication US 2002/0002807)
  - “relative” tension member contact or attachment sites (referred to as the “polygonal” embodiments), as follows:
  - f) “outer tension member attachments sites defining an outer enclosing surface that has only polygonal faces” and “inner tension member attachments that are disposed within the outer enclosing surface” (claims 43-46)
    - see Figures 6A, 6B and 6C.
    - see paragraphs 0034, 0035, 0036 and 0047 of the publication of the instant application (publication US 2002/0002807)

## VI. Issues

I. Whether the Examiner’s rejection of the all claims currently remaining in the case (claims 20-38 and 43-55) under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, 181 F.2d 1019, 86 USPQ70 (CCPA 1950) is proper in light of the limits of these claims.

II. Whether the Examiner’s rejection of claims 20, 24, 29-31 and 35 as violating the second paragraph of 35 U.S.C. 112 for purported insufficient antecedent basis is proper.

## VII. Sub-Issues:

*Note: Although Appellant could indeed conceive of other manners of organizing the issues for appeal, Appellant has chosen to organize the issues for appeal so that they "track" the claim grouping, for the convenience of the Examiner and the Board. Where appropriate, Appellant has simply incorporated arguments made relative to the patentability of a certain claim(s) in its argument for the patentability of a different claim(s) presenting analogous issues.*

- 1) Whether the Examiner's rejection of claims 20-23, 53\*, 54\* and 55\* under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 2) Whether the Examiner's rejection of claims 24-28, 53\*, 54\* and 55\* under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 3) Whether the Examiner's rejection of claims 29, 53\*, 54\* and 55\* under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 4) Whether the Examiner's rejection of claims 30, 53\*, 54\* and 55\* under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 5) Whether the Examiner's rejection of claims 31, 34, 53\*, 54\* and 55\* under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 6) Whether the Examiner's rejection of claim 32 under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 7) Whether the Examiner's rejection of claim 33 under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 8) Whether the Examiner's rejection of claims 35, 38, 53\*, 54\* and 55\* under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 9) Whether the Examiner's rejection of claim 36 under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 10) Whether the Examiner's rejection of claim 37 under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.

- 11) Whether the Examiner's rejection of claims 43, 46, 53\*, 54\* and 55\* under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 12) Whether the Examiner's rejection of claim 44 under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 13) Whether the Examiner's rejection of claim 45 under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 14) Whether the Examiner's rejection of claims 47, 53\*, 54\* and 55\* under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 15) Whether the Examiner's rejection of claims 48, 53\*, 54\* and 55\* under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 16) Whether the Examiner's rejection of claims 49, 52, 53\*, 54\* and 55\* under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 17) Whether the Examiner's rejection of claim 50 under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 18) Whether the Examiner's rejection of claim 51 under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 and on the holding in In Re Japikse, is proper.
- 19) Whether the Examiner's rejection of claims 20, 24, 29-31 and 35 as violating the second paragraph of 35 U.S.C. 112 for purported insufficient antecedent basis for the term "on the surface" is proper.
- 20) Whether the Examiner's rejection of claims 20 and 24 as violating the second paragraph of 35 U.S.C. 112 for purported insufficient antecedent basis for the term "the conjugate axis" is proper.

### **VIII. Grouping of Claims**

Claims 20-23, 53\*, 54\* and 55\* stand or fall as a group.

Claims 24-28, 53\*, 54\* and 55\* stand or fall as a group.

Claims 29, 53\*, 54\* and 55\* stand or fall together.

Claims 30, 53\*, 54\* and 55\* stand or fall together.

Claims 31, 34, 53\*, 54\* and 55\* stand or fall together.

Each of claims 32 and 33 stands or falls by itself, as each claim is not grouped with any other claim. (?)

Claims 35, 38, 53\*, 54\* and 55\* stand or fall together.

Each of claims 36 and 37 stands or falls by itself, as each claim is not grouped with any other claim. (?)

Claims 43, 46, 53\*, 54\* and 55\* stand or fall together.

Each of claims 44-45 stands or falls by itself, as each claim is not grouped with any other claim. (?)

Claims 47, 53\*, 54\* and 55\* stand or fall together.

Claims 48, 53\*, 54\* and 55\* stand or fall together.

Claims 49, 52, 53\*, 54\* and 55\* stand or fall together.

Each of claims 50 and 51 stands or falls by itself, as each claim is not grouped with any other claim. (?)

\* Claims 53, 54 and 55 are each multiply dependent claims that each depend in the alternative from every independent claim remaining in the case (claims 20, 24, 29, 30, 31, 35, 37, 43, 48 and 49); only that “aspect” of each of claims 53-55 that depends from a particular independent claim stands or falls with the independent claim in the same group. Hence, the asterisk presented alongside each of claims 53, 54 and 55 above indicates that only that aspect of the multiply dependent claim 53, 54 or 55 that depends from the specific independent claim with which it is grouped is to be included in that grouping.

## IX. Argument

### A. Issue I:

#### (1) The Examiner’s Rejection:

As to Issue I, the Examiner rejected every claim pending in the case under 35 U.S.C. § 103(a), as based on US Patent No. 3,866,366 to Fuller (Fuller ‘366, or simply Fuller) and on the holding of *In Re Japikse*, 181 F.2d 1019, 86 USPQ70 (CCPA 1950). Specifically, the Examiner’s rationale for rejecting these claims was stated as follows in the final rejection: “Claims 15-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fuller (US 3,866,366)...Fuller does not teach specifically the compression members of three-dimension structure are (sic) arranged and situated with the tension members on a surface of a first hyperboloid or hyperbolic paraboloid, of

revolution of one sheet having a mid-plane that is perpendicular to the conjugated axis of the first, second hyperboloid or hyperbolic paraboloid. It would have been obvious to one of ordinary skill in the art at the time the invention was made to arrange the compression members and the tension members situated in the different configurations such as hyperboloid or hyperbolic paraboloid with respect to the first and second surfaces, since it has been held that rearranging parts of an invention involves only routine skill in the art.” See Office Action, mailed April 9, 2003, pages 3-4.

It should be noted for clarity that although the final office action did not specifically cite In re Japikse, the Examiner did cite this case in a first office action as a legal basis for a similar case-law based “rearrangement of parts” rejection. It is thus presumed that the In re Japikse case is the basis for the rearrangement of parts rejection advanced in the final office action from which appeal is sought.

(2) Appellant’s Response:

a) SubIssues 1-18:

1. Specific Limitations in The Rejected Claims Are Not Described in the Prior Art Relied On In the Rejection, and Such Limitations Render the Claimed Subject Matter Unobvious Over the Prior Art:

*What Follows Is (For Each of Sub-Issues 1-18):*

*(a) An Identification of Specific Limitation(s) in The Rejected Claims That Are Not Described in the Prior Art Relied On In the Rejection, and*

*(b) A Description of How Such Limitation(s) Render the Claimed Subject Matter Unobvious Over the Prior Art (specifically, advantages afforded by the novel limit(s)):*

Sub-Issue 1: Claims 20-23

(a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*“wherein at least three tension members are arranged in a radial configuration”, in combination with compression members arranged in a hyperboloid configuration.*

Discussion: Neither Fuller ‘366 (please see its Figures 8-12) nor any other prior art describes a “radial” tension member arrangement (“radial guying”) as in claims 20-23, and as shown and described in the instant application.

(b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

*Advantages:*

***Enhanced Strength:*** The use of radial guying as claimed in the instant application as combined with perhaps other types of guying and adjacently attached or nested compression member modular configurations allows structural redundancy to be achieved whereas Fuller '366 and prior art without radial guying do not teach this possibility.

Also, see the Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, first paragraph to start on page 6; and page 12-13, paragraph (b), including the text on page 13 "This [radial tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose radial tension member configurations."

***Enhanced Structural Integrity:*** Further, an improvement in structural integrity, particularly in structural response to an applied force, is realized with the radial tension member configuration, as compared with the configuration of tension elements in Fuller '366 and prior art without radial guying. More specifically, when an overall tensile force is applied to a structure having a radial arrangement of tension members, and that tensile force is applied in a plane that is substantially parallel to the plane in which the radial arrangement of tension members is situated (e.g., an end plane), the structure's design causes a more effective resistance to the force than is observed with the manner of guying exhibited in Fuller and prior art without radial guying, resulting in less deformation per given tensile load than is observed in Fuller and prior art without radial guying, and an increase in the reactive tensile stresses in a radial configuration that is, e.g., approximately one-half of the increase observed in Fuller.

***Composite Structure Related Advantages:*** One additional modification of operation of Fuller and prior art without radial guying that is attributable to the radial tension member configuration is manifested upon the creation of composite structures from individual unit structures that have radial tension member configurations in the upper and/or lower end planes (when the composite structure is, e.g., a slab, and is created by, e.g., attaching several of the structures shown in Fig. 2A of the instant application adjacent one another, so that use of the terms upper/lower end planes is proper). When contiguous individual unit structures all have radial tension member configurations in either the upper and/or lower end planes (i.e., all units have radial tension member configurations in the upper plane, or all units have radial tension member configurations in the lower planes, or all units have radial tension member configurations in the upper and lower planes), a network of "continuous" tension members running parallel to each other in each of three separate directions is observed. This arrangement has significant strength benefits as compared with structures such as Fuller that do not disclose radial tension member configurations. In these ways, a functional and operational improvement in strength per weight and strength per unit cost is observed.

***Material Efficiency:*** One additional manner in which the radial guying configuration claims “modify” the operation of Fuller ‘366 and other “non-radially guyed” structures is by reducing the overall length of guys that are arranged in a manner other than radial. Additionally, a radial tension member configuration will reduce the number of tension member attachments at at least one of the compression member ends, resulting in a more simplified, more easily manufactured, and possibly a less expensive structure.

See also, paragraph 0024 of the publication of the instant application (describing Fig. 2A), discussing a hyperboloid structure with a radial configuration of tension members, and pointing out that “This radial arrangement requires only 58% of the length required in the circumferential arrangement of Fig. 1A.”

### **Sub-Issue 2: Claims 24-28**

(a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*“wherein at least one tension member is configured in an internal configuration”,* in combination with compression members arranged in a hyperboloid configuration.

Discussion: Neither Fuller ‘366 (please see its Figures 8-12) nor any other prior art describes an “internal” tension member arrangement (“internal guying”) as in claims 24-28, and as shown and described in the instant application.

(b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

#### **Advantages:**

***Enhanced Strength:*** The use of internal guying as claimed in the instant application as combined with perhaps other types of guying and adjacently attached or nested compression member modular configurations allows structural redundancy to be achieved whereas Fuller does not teach this possibility.

Also, see the Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, first paragraph to start on page 6; and page 13-14, paragraph (c), including the text on page 14 “This [internal tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose internal tension member configurations.”

***Enhanced Structural Integrity:*** Further, an improvement in structural integrity, particularly in structural response to an applied force, is realized with the internal tension member configuration as compared with the configuration of Fuller’s

tension elements. More specifically, when an overall tensile force is applied to a structure having an internal arrangement of tension members that is attached to compression members such that points of attachment are in, e.g., one end plane, and that tensile force is applied in a plane that is substantially parallel to that end plane, the structure's design causes a more effective resistance to the applied force than is observed with the manner of guying exhibited in Fuller, resulting in less deformation per given tensile load than is observed in Fuller, and an increase in the reactive tensile stresses of the internal configuration that is approximately one-half of the increase observed in Fuller.

***Improvements Relative to Composite Structures:*** One additional modification of operation of Fuller that is attributable to the internal tension member configuration of the indicated claims is manifested upon the creation of composite structures from individual unit structures that have internal tension member configurations in the upper and/or lower end planes (when the composite structure is, e.g., a slab, and is created by, e.g., attaching several of the structure shown in Fig. 2B of the instant application adjacent one another, so that such upper/lower end plane nomination is proper). When contiguous individual unit structures all have internal tension member configurations in either the upper and/or lower end planes (i.e., contiguous units have internal tension member configurations in the upper plane, or contiguous units have internal tension member configurations in the lower planes, or contiguous units have internal tension member configurations in the upper and lower planes), a network of "continuous" tension members running parallel (when viewed from above, e.g.) to each other in each of three separate directions is observed, although, as different from the composite slab structures having a radial tension member configuration, the composite structures having internal tension member configurations in the upper and/or lower end planes might have a \VVV profile (instead of a ----- profile that would likely be observed with the slabs having radially tensioned end planes). This arrangement has significant strength benefits as compared with structures such as Fuller. Importantly, each of these functionalities and operational improvements are realized without compromising the integrity or strength of the structure, and indeed in many cases, result in an increase in the strength and integrity of the structure. Simply, and as explained, the "non-internal" tension element configuration of Fuller simply does not allow or provide for the operational capabilities afforded by an internal tension member configuration.

***Structural Simplification:*** One additional manner in which claims requiring an internal guying configuration modify the operation of Fuller and prior art without internal guying is by allowing a directing of tension members along pathways that simply is not possible with Fuller and its configuration of tension elements. This enablement allows for the avoidance of obstructions and/or the achievement of other design goals such as preferred tension member attachments points. See also, paragraph 0025 of the publication of the instant application (describing Fig. 2B), discussing a hyperboloid structure with an internal configuration of tension members, and pointing out that "This guy [tension member] configuration allows achievement of certain design goals not possible with the circumferential or radial arrangements.

**Material Efficiency:** Additionally, internal tension member configuration will reduce the number of tension member attachments at least one of the compression member ends as compared with Fuller, resulting in a more simplified, more easily manufactured, and possibly, a less expensive structure.

### **Sub-Issue 3: Claim 29**

- (a) Limits Of the Relevant Rejected Claims That Are Not Described in the Prior Art:

*"at least three compression members that each lie on the surface of one of at least three different planes that intersect one another; and"*

*"wherein at least three tension members of said set of at least six tension members are arranged in a radial configuration"*

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes a "radial" tension member arrangement in combination with the compression member arrangement as in claim 29, and as shown and described in the instant application.

- (b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

#### **Advantages:**

The advantages discussed in Sub-Issue 1 above are incorporated herein by reference, and apply to Sub-Issue 3, in addition to the following "planar compression member arrangement" advantages:

**Enhanced Strength:** For a given material and size of the compression and tension members, planar structures as claimed in the instant application would be stronger due to Fuller '366' (and other prior art's) more shallow angles between the tension and compression members (internal structural tension and compression forces to resist external structural loading increase with decreasing angle between tension and compression members).

With appropriate combinations of radial, circumferential and internal guying, planar structures as claimed in the instant application could be made stronger as guys could be arranged to more directly react the tension loads than could Fuller or other prior art.

***Advantages Relative to Modularity*** (natural fit for adjacent or "nested" structures): Selected planar structures as claimed in the instant application can be attached adjacently at naturally occurring structural points (with no space in between) in all three spatial dimensions whereas Fuller's structure can only similarly be attached

adjacently in one dimension. This feature would allow the construction of curved, three dimensional, freestanding structures such as a dome for a stadium with the inventive planar structures but not with Fuller's structure.

Planar structures as claimed in the instant application can be nested (overlapped) for additional design options whereas Fuller's structures cannot.

***Material Efficiency:*** Selected planar structures as claimed in the instant application can achieve Fuller's object of providing "zones of rectangular like configuration" with twelve compression members whereas Fuller teaches structures that require 20 and 30 compression members.

Selected planar structures as claimed in the instant application with appropriate combinations of radial, circumferential and internal guying can achieve Fuller's object with less than 50% of the total length of guys or tension members as taught by Fuller.

***Structural Simplification:*** Selected planar structures as claimed in the instant application can achieve Fuller's object with fewer compression members.

Selected planar structures as claimed in the instant application can achieve Fuller's object with fewer tension member attachments at each attachment point (i.e. two or three tension member attachments with the planar structures as claimed in the instant application whereas Fuller requires four.

***Natural Stability:*** Selected planar structures as claimed in the instant application can achieve a natural structural stability with as few as two (with radial or internal guying) or three (with circumferential or internal guying) guys or tension members attached at each attachment point whereas Fuller requires four tension members attached at each attachment point to achieve structural stability.

#### **Sub-Issue 4: Claim 30**

(a) Limits Of the Relevant Rejected Claims That Are Not Described in the Prior Art:

*"at least three compression members that each lie on the surface of one of at least three different planes that intersect one another"*

*"wherein at least one tension member of said set of at least six tension members is arranged in an internal configuration",*

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes an "internal" tension member arrangement as in claim 30, and as shown and described in the instant application.

(b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

Advantages: The advantages discussed in Sub-Issue 2 above are incorporated herein by reference, and apply to Sub-Issue 4; the “planar compression member advantages” discussed in Sub-Issue 3 are also incorporated herein by reference and apply to Sub-Issue 4.

**Sub-Issue 5: Claims 31, 34**

(a) Limits Of the Relevant Rejected Claims That Are Not Described in the Prior Art:

*“at least four compression members that lie on the surfaces of two different planes that intersect one another”,*

Discussion: Neither Fuller ‘366 (please see its Figures 8-12) nor any other prior art describes such an arrangement of compression members. Fuller ‘366 and other prior art may disclose 2 compression members that lie on the surfaces of two different intersecting planes, but no prior art discloses “at least four compression members that lie on the surfaces of two different planes that intersect one another”, as in claims 31 and 34, and as shown and described in the instant application.

(b) How Such Limit(s) Renders the Claimed Subject Matter Unobvious Over the Prior Art:

Advantages: the “planar compression member advantages” discussed in Sub-Issue 3 are also incorporated herein by reference and apply to Sub-Issue 5.

**Sub-Issue 6: Claim 32**

(a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*“wherein at least one tension member is arranged in an internal configuration”*

Discussion: Neither Fuller ‘366 (please see its Figures 8-12) nor any other prior art describes an “internal” tension member arrangement as in claim 32, and as shown and described in the instant application.

(b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

Advantages: The advantages discussed in Sub-Issue 2 above are incorporated herein by reference, and apply to Sub-Issue 6.

#### **Sub-Issue 7: Claim 33**

- (a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*"wherein at least three tension members are arranged in a radial configuration."*

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes a radial tension member arrangement as in claim 33, and as shown and described in the instant application.

- (b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

Advantages: The advantages discussed in Sub-Issue 1 above are incorporated herein by reference, and apply to Sub-Issue 7.

#### **Sub-Issue 8: Claims 35 and 38**

- (a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*"a first set of at least two compression members situated on the surface of a first hyperbolic paraboloid;*

*a second set of at least two compression members situated on the surface of a second hyperbolic paraboloid"*

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes a double hyperbolic paraboloid compression member arrangement as in claims 35 and 38, and as shown and described in the instant application.

- (b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

Advantages:

***Enhanced Strength:*** For a given material and size of the compression and tension members, hyperbolic paraboloid structures as claimed in the instant application would be stronger than Fuller's structure due to Fuller's more shallow angles between the tension and compression members (internal structural tension and

compression forces to resist external structural loading increase with decreasing angle between tension and compression members).

With appropriate combinations of radial, circumferential and internal guying, hyperbolic paraboloid structures as claimed in the instant application could be made stronger as guys could be arranged to more directly react the tension loads as compared with Fuller's.

***Advantages Relative to Modularity*** (natural fit for adjacent or “nested” structures): Selected hyperbolic paraboloid structures as claimed in the instant application can be attached adjacently at naturally occurring structural points (with no space in between) in all three spatial dimensions whereas structures such as Fuller's and certain others' can only similarly be attached adjacently in one dimension. This feature would allow the construction of curved, three dimensional, freestanding structures such as a dome for a stadium with selected hyperbolic paraboloid structures as claimed in the instant application but not with Fuller's or certain other structures.

Hyperbolic paraboloid structures as claimed in the instant application can be nested (overlapped) for additional design options whereas Fuller's structures cannot.

***Natural Stability:*** Selected hyperbolic paraboloid structures as claimed in the instant application can achieve a natural structural stability with as few as two (with radial or internal guying) or three (with circumferential or internal guying) guys or tension members attached at each attachment point whereas Fuller requires four tension members attached at each attachment point to achieve structural stability.

#### **Sub-Issue 9: Claim 36**

(a) Limit Of the Relevant Rejected Claims That Are Not Described in the Prior Art:

*“wherein at least one of said at least twelve tension members is arranged in an internal configuration.”* (in combination with the above-mentioned limit of claim 35, the base claim of dependent claim 37)

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes an internal tension member arrangement as in claim 36, and as shown and described in the instant application.

(b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

***Advantages:*** The advantages discussed in Sub-Issue 2 above are incorporated herein by reference, and apply to Sub-Issue 9.

### **Sub-Issue 10: Claim 37**

(a) Limits Of the Relevant Rejected Claims That Are Not Described in the Prior Art:

- “*wherein at least three of said set of at least twelve tension members are arranged in a radial configuration.*” (in combination with the above-mentioned limit of claim 35, the base claim of dependent claim 37)

Discussion: Neither Fuller ‘366 (please see its Figures 8-12) nor any other prior art describes a radial tension member arrangement as in claim 37, and as shown and described in the instant application.

(b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

*Advantages:* The advantages discussed in Sub-Issue 1 above are incorporated herein by reference, and apply to Sub-Issue 10.

### **Sub-Issue 11: Claims 43 and 46**

(a) Limits Of the Relevant Rejected Claims That Are Not Described in the Prior Art:

*“an outer set of at least six tension members that connects said at least four compression members with one another at outer tension member attachments; and*

*an inner set of at least four tension members that connects said at least four compression members with one another at inner tension member attachments,*

*wherein said inner tension member attachments and said outer tension member attachments are disposed on said at least four compression members,*

*wherein said outer tension member attachments define an outer enclosing surface that has only polygonal faces, and*

*wherein said inner tension member attachments are disposed within said outer enclosing surface.”*

Discussion: Neither Fuller ‘366 (please see its Figures 8-12) nor any other prior art describes a tension member and compression member arrangement as in claims 43 and 46, and as shown and described in the instant application.

- (b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

*Advantages:*

***Enhanced Strength:*** One way that claims 43-46 modify the operation of Fuller is by improving structural integrity and strength by providing a structure that has the ability to more effectively recruit tension members in response to an applied external force for a structure requiring a polygonal arrangement of compression members.

**Sub-Issue 12: Claim 44**

- (a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*"wherein at least one tension member is arranged in an internal configuration."* (in combination with the above-mentioned limit of claim 43, the base claim of dependent claim 44)

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes an internal tension member arrangement as in claim 44, and as shown and described in the instant application.

- (b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

*Advantages:* The advantages discussed in Sub-Issue 2 above are incorporated herein by reference, and apply to Sub-Issue 12.

**Sub-Issue 13: Claim 45**

- (a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*"wherein at least three tension members are arranged in a radial configuration"* (in combination with the above-mentioned limit of claim 43, the base claim of dependent claim 45)

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes a radial tension member arrangement as in claim 45, and as shown and described in the instant application.

- (b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

Advantages: The advantages discussed in Sub-Issue 1 above are incorporated herein by reference, and apply to Sub-Issue 13.

#### **Sub-Issue 14: Claim 47**

- (a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*"wherein at least three of said at least six tension members are arranged in a radial configuration."*

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes a radial tension member arrangement as in claim 47, and as shown and described in the instant application.

- (b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

Advantages: The advantages discussed in Sub-Issue 1 above are incorporated herein by reference, and apply to Sub-Issue 14.

#### **Sub-Issue 15: Claim 48**

- (a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*"wherein at least one of said tension members is arranged in an internal configuration."*

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes an internal tension member arrangement as in claim 48, and as shown and described in the instant application.

- (b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

Advantages: The advantages discussed in Sub-Issue 2 above are incorporated herein by reference, and apply to Sub-Issue 15.

#### **Sub-Issue 16: Claims 49 and 52**

- (a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*"wherein at least two of said at least three compression members are situated on the surface of a first hyperboloid of revolution of one sheet;*

*wherein at least one other compression member of said at least three compression members is situated on the surface of at least a second hyperboloid of revolution of one sheet”*

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes a “double hyperboloid” compression member arrangement as in claims 49 and 52, and as shown and described in the instant application.

(b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

*Advantages:*

***Enhanced Strength:*** For a given material and size of the compression and tension members, double hyperboloid structures as claimed in the instant application would be stronger than Fuller's structure due to Fuller's more shallow angles between the tension and compression members (internal structural tension and compression forces to resist external structural loading increase with decreasing angle between tension and compression members).

***Modularity Advantages*** (natural fit for adjacent or “nested” modules): Selected double hyperboloid structures as claimed in the instant application can be attached adjacently at naturally occurring structural points (with no space in between) in all three spatial dimensions whereas Fuller's and certain others' structures can only similarly be attached adjacently in one dimension. This feature would allow the construction of curved, three dimensional, freestanding structures such as a dome for a stadium.

Double hyperboloid structures can be nested (overlapped) for additional design options whereas Fuller's structures cannot.

Indeed, one way that claims directed to a double hyperboloid compression member configuration “modify” the operation of Fuller is by facilitating creation of composite structures generated by horizontal expansion (horizontal according to Fig. 2A-2D) and by facilitating the creation of composite structures exhibiting a more geometrically compatible arrangement.

***Material Efficiency:*** Selected double hyperboloid structures as claimed in the instant application can achieve Fuller's object of providing “zones of rectangular like configuration” with a reduced number of required compression members. Only four (eight in at least one other embodiment) compression members are needed in selected double hyperboloid structures as claimed in the instant application whereas Fuller teaches structures that require 20 and 30 compression members.

Selected double hyperboloid structures as claimed in the instant application with appropriate combinations of radial, circumferential and internal guying can achieve Fuller's object with less than 50% of the total length of guys or tension members as taught by Fuller.

***Structural Simplification:*** Selected double hyperboloid structures as claimed in the instant application can achieve Fuller's object of providing "zones of rectangular like configuration" with fewer compression members.

Selected double hyperboloid structures as claimed in the instant application can achieve Fuller's object with fewer tension members.

Selected double hyperboloid structures as claimed in the instant application can achieve Fuller's object with fewer tension member attachments at each attachment point (i.e. two or three tension member attachments with at least one claimed embodiment of the instant invention whereas Fuller requires four).

***Natural Structural Stability:*** Selected double hyperboloid structures as claimed in the instant application can achieve a natural structural stability with as few as two (with radial or internal guying) or three (with circumferential or internal guying) guys or tension members attached at each attachment point whereas Fuller requires four tension members attached at each attachment point to achieve structural stability.

### **Sub-Issue 17: Claim 50**

(a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*"wherein at least one of said tension members is arranged in an internal configuration."* (in combination with the above-mentioned limit of claim 49, the base claim of dependent claim 50)

Discussion: Neither Fuller '366 (please see its Figures 8-12) nor any other prior art describes an internal tension member arrangement as in claim 50, and as shown and described in the instant application.

(b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

***Advantages:*** The advantages discussed in Sub-Issue 2 above are incorporated herein by reference, and apply to Sub-Issue 17.

### **Sub-Issue 18: Claim 51**

(a) One Limit Of the Relevant Rejected Claims That Is Not Described in the Prior Art:

*“wherein at least three of said tension members are arranged in a radial configuration.”* (in combination with the above-mentioned limit of claim 49, the base claim of dependent claim 51)

Discussion: Neither Fuller ‘366 (please see its Figures 8-12) nor any other prior art describes a radial tension member arrangement as in claim 51, and as shown and described in the instant application.

(b) How Such Limit Renders the Claimed Subject Matter Unobvious Over the Prior Art:

Advantages: The advantages discussed in Sub-Issue 1 above are incorporated herein by reference, and apply to Sub-Issue 18.

*Appellant notes that as to the above discussion of certain of the Sub-Issues (Sub-Issues 1-5, 8, 11 and 14-16), the Claims 53\*. 54\* and 55\* should also be considered as part of that specific group (as indicated above in the listing of the Sub-Issues) to the extent that claims 53\*. 54\* and 55\* depend from claims of these certain Sub-Issues; reference to them has been omitted merely to focus issues on the limits of the claims from which 53\*, 54\* and 55\* depend.*

2. Errors in the Examiner’s 35 U.S.C. §103 Rejection:

a. The Examiner Has Not Established a Prima Facie Case of Obviousness

As the Board is well aware, “[T]he Examiner bears the initial burden of factually supporting any prima facie conclusion of obviousness.” MPEP 2142. The MPEP goes on to state that “To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations” MPEP 2143, Basic Requirements of a Prima Facie Case of Obviousness. Appellant submits that one reason the Examiner’s rejection is improper is that these three criteria have not been met with respect to the Fuller reference, and explains its position as follows:

The Prior Art Reference(s) Does Not Teach or Suggest All Claim Limitations: Simply, as explained above, each claim contains at least one limit that is not taught or suggested by the prior art, including the Fuller ‘366 reference.

There is No Suggestion or Motivation to Modify the Reference: There is no suggestion or motivation, either in Fuller itself or in knowledge generally available to one

of ordinary skill in the art, to modify Fuller or any other prior art to arrive at any of the instant application's new claims. Simply, the Office has not pointed to any evidence of such motivation or suggestion to modify Fuller so as to arrive at the inventive subject matter as described by the new claims. The prior art must provide a motivation or reason for the worker in the art, without the benefit of Appellant's specification, to make the necessary changes in the reference device." Ex parte Chicago Rawhide Mfg. Co., 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984). The Examiner has pointed to no motivation or reason for the worker in the art to make the necessary changes in the Fuller device.

There is no Reasonable Expectation of Success of the Inventive Subject Matter: Simply, the Office has not set forth any evidence suggesting the modifications would be successful.

Even if the Examiner were able to find a reference that disclosed certain shapes, such would not, in combination with a self-guyed structure reference, establish a valid obviousness rejection as to the relevant claims because, as but three reasons, the references would not include a motivation to combine or modify, would still not disclose the subject matter as claimed, and would originate from outside the field of self-guyed structures.

b. The In re Japikse Case On Which the Examiner Relies Is Not Properly Applied to the Claims in the Instant Application

1. *The New Site of the Repositioned Switch of the Rejected Claims of In re Japikse was Itself Known in the Relevant Field, But the New Site of Repositioned Elements in the Rejected Claims of the Instant Application is Not Known in the Relevant Field:*

In In re Japikse, (cite), the Court of Customs and Patent Appeals upheld a rejection of a claim whose novel feature was the relocation of a known switch to a new site for that switch, where this new site itself was also known, and, significantly, was known in association with the art to which the claim at issue related. In In re Japikse, the new site for the known switch was already there, as a known part of a known apparatus. However, in the instant case, the new location of the known element(s) is not known in the field of self-guyed structures. Particularly, as discussed above, each of the claims remaining in the instant case includes a limit that is, in effect, a new location that, also as discussed above, is not known in the art of self-guyed structures:

Unlike in the In re Japikse case, there is no prior art in the relevant field (in the instant application, self-guyed structures) that discloses the new location to which the known elements (in the instant application, compression members, tension members or their relative positioning) are repositioned. For this reason, the In re Japikse case does not set forth proper legal grounds for rejecting claims now pending in the instant application as obvious.

Indeed, even if the Examiner had taken official notice that certain limits of the claims relate to shapes (e.g., a hyperbolic paraboloid) that are known in mathematics, the above discussed reason why In re Japikse is not applicable to the instant facts would still apply - because these known shapes/locations are not known in the field of self-guyed structures.

It should be noted that although it is not clear from the In re Japikse case which piece of prior art specifically disclosed the location or area to which the switch was newly relocated, each of the patent references used during prosecution to support the rejection of the claims directed at the press with a newly located switch (claims 5 and 6) related to the relevant technology of presses and transfer tables, and the case indicates that the only novel feature of these claims is the repositioning of the switch.

*2. The In re In re Japikse Holding is Not Properly Applicable To the Instant Application Because the In re In re Japikse Case Involved the Relocation of Only One Component of the Prior Art, While the Instant Claims Involve the Relocation of Most, If Not All Components.*

The Japikse holding is not properly applicable to the facts in the instant application because Japikse involved claims that were new with respect to the prior art merely in a shifting of the position of merely one component (the starting switch) of the known apparatus. The claims of the instant application involve a significantly more substantial re-configuration – indeed, the instant claims require a total repositioning of every compression element and tension element of Fuller (presuming that Fuller’s elements could even be repositioned as such). Such a repositioning is vastly more complex than merely moving a switch. Certain of the claims of the instant application involve arrangement of compression members onto the surfaces of shapes onto which no one has heretofore arranged compression members (such as, e.g., onto the surfaces of hyperbolic paraboloids). Certain of the claims of the instant application also involve arrangement of the tension members in novel radial or internal configurations. Certain of the claims involve reducing the number of compression members and/or the planes on which these compression members are situated. Certain of the claims involve novel structures having inner compression member-to-tension member attachments that are situated within polygonal faces formed by outer compression members. Appellant submits that each these novel aspects of the claims of the instant application are more significant and substantial than simply moving the fixed position of a starting switch – the one novel aspect of the claims on appeal in the In re Japikse case upon which the Office bases its §103 rejection of the application’s instant claims.

The Appellant further submits that although the components of the apparatus on which the relevant In re Japikse claims (i.e., those claims that were different from prior art merely in the movement of a single component, a switch) were rejected could indeed be rearranged to create the apparatus described by the relevant rejected claims in that case, no such presumption can be made in the instant case. In other words, although the components of In re Japikse could be rearranged to create the new apparatus, it cannot be said that the components of the Fuller apparatus (the prior art over which the rejected

claims of the instant application have been rejected) can be so arranged because in order to create the apparatus described by the instant application's pending claims, certain relative length constraints must be met by compression and tension members for it to even be possible that the apparatus described by any of the pending claims be free-standing. Simply, there is no indication that the compression and tension members of the Fuller reference's apparatus meet these limits, and thus it is entirely uncertain whether someone could take Fuller's apparatus, disassemble it, and, without adaptation of the apparatus' component parts, rearrange it to form an apparatus described by any of the instant application's remaining claims. However, in *In re Japikse*, one could very easily take the elements of the relevant prior art (again which was different only in the location of a starting switch) and rearrange them to form the apparatus described by the claims whose rejection was upheld. This is yet another reason why the *In re Japikse* case is improper as a legal basis for rejecting the claims pending in the instant case.

*3. The In re Japikse Holding Should Be Limited In Application to Claims That Are Distinguishable From Prior Art In A Manner Similar to That Found in In re Japikse*

The Appellant submits that caution should be exercised in applying the *In re Japikse* case. Although the MPEP cites the case under the heading "Rearrangement of Parts" (see MPEP 2144.05 C.) Appellant submits that it would be only properly applicable when a single, known part of an apparatus consisting of many parts is relocated to a discrete, known location on that apparatus. However, of course, the claims in the instant application would require the rearrangement of all (or nearly all) of the components of the Fuller reference into new locations that are not disclosed in the prior art.

*4. Other Cases Whose Holdings Turn On Functional Significance of The Distinguishing Elements of the Claims Are Illustrative and More Properly Applicable to the Instant Application*

Appellant submits that other federal decisions regarding obviousness rejections, although not directly applicable to the instant case, are illustrative in that they clearly indicate that the focus of the inquiry should be whether the claimed distinguishing features are significant (e.g., in enhancing function). See, e.g., *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966) (a novel configuration for a claimed disposable plastic nursing container was obvious absent persuasive evidence that the particular configuration of the claimed container was significant); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984) (claims including a novel recitation of relative dimensions of the claimed device were not patentable where a device having the claimed relative dimensions would not perform differently than the prior art device); and *Ex Parte Hilton*, 148 USPQ 356 (Bd. App. 1965) (Claims were directed to fried potato chips with a specified moisture and fat content, whereas the prior art was directed to french fries having a higher moisture content; while recognizing that in some cases the particular shape of a product is of no patentable significance, the Board held in this case that the shape (chips) is important

because it results in a product which is distinct from the reference product (french fries) in having a lower moisture content).

As indicated in the discussion above relative to each Sub-Issue and the Advantages afforded by distinguishing limits of the claims of each Sub-Issue, each of the claims remaining in the instant application do indeed contain limit(s) that are significant in that they enhance strength; facilitate or enable attachment of repeating structural units; enhance material requirement efficiency; simplify the structure and its construction; and/or impart an enhanced structural stability (as but a few examples), as compared with the Fuller reference over which the claims were rejected (and indeed with other prior art self-guyed structures).

*5. The Fact That Many Other Self-Guyed Structure Patents Have  
Been Issued In the Face of Other Self-Guyed Structure Prior Art Suggests  
that the Examiner's Reliance on *In Re Japikse* is Improper*

The mere fact that other patents for self-guyed structures have issued since the date of the *In re Japikse* decision, where these patents “merely” claimed new locations of tension members and/or compression members (e.g., Fuller ‘366), and where these patents were allowed over prior art that disclosed compression members and tension members (although not in the particular configurations claimed in the allowed patents), suggests that the Examiner’s rejection is improper.

c. Possibility of Modification of Prior Art To Arrive At the Claimed Subject Matter Is an Insufficient Basis for a §103 Rejection

Further, the mere fact that references can be combined or modified (although Appellant certainly does not concede that such is the case), does not render the resultant combination (or, presumably, modification) obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Indeed, “[T]he mere fact that a worker in the art could rearrange the parts of the reference device to meet the terms of the claims on appeal is not by itself sufficient to support a finding of obviousness. As yet another reason why the 35 U.S.C. §103 rejection of the claims remaining in the case should be reversed, the prior art simply does not suggest the desirability of the combination.

d. Obvious To Try, or Design Choice Rejections are Also Insufficient Bases For a §103 Rejection

The Examiner’s rejection appears a species of “obvious to try” or “design choice” type rejection. However, unsupported assertions of what those skilled in the art might have done do not provide a level of support which meets the Office’s burden of proof. Of course, those skilled in the art could have tried to accomplish much had they had the knowledge and perspectives of the present inventor. With the hindsight of these perspectives, they might have even tried to achieve the present invention -- but as the art of record poignantly shows, they did not. To a large degree, the Fuller reference cited

actually shows the exact opposite -- that the understanding of those skilled in the art at the time the invention was made did not include the perspective which the present inventor had. To say that those of ordinary skill could have achieved the various claimed elements is simply unsupported. Of course, once traversed, it is improper to maintain an unsupported allegation. As the courts have long stated:

“[W]e reject the notion that judicial or administrative notice may be taken of the state of the art. The facts constituting the state of the art are normally subject to the possibility of rational disagreement among reasonable men and are not amenable to the taking of such notice. If evidence of the knowledge possessed by those skilled in the art is to be properly considered, it must be timely injected into the proceedings”

In re Eynde, 480 F.2d 1364 (CCPA 1973).

To maintain allegations as to design choice, evidence is necessary - personal impressions as to what might be obvious is not sufficient. The Appellant has traversed the allegations and – to the extent not now mooted by the response – requests evidence to support each of the propositions proposed. Further, while several specific allegations are addressed below, this request should be understood to apply to each of the unsupported allegations raised in the action.

In general summary, there simply is no adequate support for an assertion that the claims would have been obvious to a person of ordinary skill in the art and in fact they would not have been so obvious. It is believed that the above is adequate to efficiently show that the initial concern was not correct.

**B. Issue II:**

(1) The Examiner's Rejection:

As to Issue II, the Examiner rejected claims 15, 20, 24, 29-31 and 35 under 35 U.S.C. §112, second paragraph, specifically stating that there is insufficient antecedent basis for the limitation “on the surface” in the claims. The Examiner also rejected claims 15, 20 and 24 under 35 U.S.C. §112, second paragraph, specifically stating that there is insufficient antecedent basis for the limitation “the conjugate axis” in the claim.

(2) Appellant's Response:

a) SubIssues 19 and 20:

1. The Claims Do In Fact Particularly Point Out and Distinctly Claim the Subject Matter Which Appellant Regards as The Invention:

As stated in MPEP 2173.05(e), “[i]nherent components of elements recited have antecedent basis in the recitation of the components themselves. For example, the limitation “the outer surface of said sphere” would not require an antecedent recitation that the sphere has an outer surface. See *Bose Corp. v. JBL, Inc.*, 274 F.3d 1354, 1359, 61 USPQ2d 1216, 1218-19 (Fed. Cir. 2001) (holding that recitation of “an ellipse” provided antecedent basis for “an ellipse having a major diameter” because “[t]here can be no dispute that mathematically an inherent characteristic of an ellipse is a major diameter.”)

These cases are directly on point. Claims 20, 24, 29-31 and 35 involve hyperboloids (claims 20 and 24), planes (claims 29-31) and hyperbolic paraboloids (claim 35). The claim term “surface” is used in association with each of the claim terms “hyperboloid”, “plane”, and “hyperbolic paraboloid.” The claim term “conjugate axis” is used in association with the claim term “hyperboloid.” There can be no dispute that mathematically an inherent characteristic of each a hyperboloid, a plane, and a hyperbolic paraboloid is a surface, and that mathematically an inherent characteristic of a hyperboloid is a conjugate axis. Thus, the Appellant submits that claims 20, 24, 29-31 and 35 do indeed comply with 35 U.S.C. 112, second paragraph, as the “surface” and the “conjugate axis” components inhere in each hyperboloids, planes, and hyperbolic paraboloids as indicated above, and thus have antecedent basis in their own recitation.

It should be noted that the Examiner also set forth a few minor objections to the specification in the final office action. These formality type objections can be attended to at a later date.

#### C. *Explanation of Claim Groupings:*

a) Claims 20-23, 53\*, 54\* and 55\* stand or fall together. The patentability with respect to certain limit(s) of independent claim 20 as claimed (in combination with the hyperboloid configuration of compression members), this limit being:

- “*wherein at least three tension members are arranged in a radial configuration*”,

has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, first paragraph to start on page 6; and page 12-13, paragraph (b), including the text on page 13 “This [radial tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose radial tension member configurations.”; See also, paragraph 0024 of the publication of the instant application (describing Fig. 2A), discussing a hyperboloid structure with a radial configuration of tension members, and pointing out that “This radial arrangement requires only 58% of the length required in the circumferential arrangement of Fig. 1A.”)

The patentability with respect to the limit(s) added by each of dependent claims 21-23 (and of any limit added by claims 53, 54 and 55), has not been expressly urged

before the Office and thus dependent claims 21- 23 (and that “aspect” of each of multiply dependent claims 53, 54 and 55 that depends from claim 20) stand or fall with the independent claim from which they depend, claim 20, as presumed.

b) Claims 24-28, 53\*, 54\* and 55\* stand or fall together. The patentability with respect to certain limit(s) of independent claim 24 as claimed (in combination with the hyperboloid configuration of compression members), this limit being:

- *“wherein at least one tension member is configured in an internal configuration”,*

has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, first paragraph to start on page 6; and page 13-14, paragraph (c), including the text on page 14 “This [internal tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose internal tension member configurations.”; See also, paragraph 0025 of the publication of the instant application (describing Fig. 2B), discussing a hyperboloid structure with an internal configuration of tension members, and pointing out that “This guy [tension member] configuration allows achievement of certain design goals not possible with the circumferential or radial arrangements.”

The patentability with respect to the limit(s) added by each of dependent claims 25-28 (and of any limit added by claims 53, 54 and 55), has not been expressly urged before the Office and thus dependent claims 25, 26, 27 and 28 (and that “aspect” of each of multiply dependent claims 53, 54 and 55 that depends from claim 24) stand or fall with the independent claim from which they depend, claim 24, as presumed.

c) Claims 29, 53\*, 54\* and 55\* stand or fall together. The patentability with respect to certain limit(s) of independent claim 29 as claimed, this limit being:

- “wherein at least three tension members of said set of at least six tension members are arranged in a radial configuration”,*

has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, first paragraph to start on page 6; and page 12-13, paragraph (b), including the text on page 13 “This [radial tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose radial tension member configurations.”; See also, paragraph 0024 of the publication of the instant application (describing Fig. 2A), discussing a hyperboloid structure with a radial configuration of tension members, and pointing out that “This radial arrangement requires only 58% of the length required in the circumferential arrangement of Fig. 1A.”; and see paragraph 0036 of the publication of the instant application (describing Fig. 6C), discussing a “polygonal” structure having a radial configuration of tension members and pointing out

that such configuration “requires only 58% of the length required in the circumferential arrangement.”)

Claim 29 has no dependent claims other than the indicated claims 53, 54 and 55. The patentability with respect to any limit added by each of dependent claims 53, 54 and 55 has not been expressly urged before the Office and thus that “aspect” of each of multiply dependent claims 53, 54 and 55 that depends from claim 29 stands or falls with the independent claim from which it depends, claim 29, as presumed.

d) Claims 30, 53\*, 54\* and 55\* stand or fall together. The patentability with respect to certain limit(s) of independent claim 29 as claimed, this limit being :

*“wherein at least one tension member of said set of at least six tension members is arranged in an internal configuration”,*

has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, first paragraph to start on page 6; and page 13-14, paragraph (c), including the text on page 14 “This [internal tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose internal tension member configurations.”; also, the publication of the instant originally filed application, US 2002/0002807 A1, paragraph [0029], which refers to a 6 strut planar self-guyed structure with an internal guy (tension member) arrangement and which states in part that the internal guy arrangement “...also can be used to reduce the total length of guy members necessary to provide structural integrity to the icosahedron or to achieve other design goals”; see also, paragraph 0025 of the publication of the instant application (describing Fig. 2B), discussing a hyperboloid structure with an internal configuration of tension members, and pointing out that “This guy [tension member] configuration allows achievement of certain design goals not possible with the circumferential or radial arrangements.”)

Claim 30 has no dependent claims other than the indicated claims 53, 54 and 55. The patentability with respect to any limit added by each of dependent claims 53, 54 and 55 has not been expressly urged before the Office and thus that “aspect” of each of multiply dependent claims 53, 54 and 55 that depends from claim 30 stands or falls with the independent claim from which it depends, claim 29, as presumed.

e) Claims 31, 34, 53\*, 54\* and 55\* stand or fall together. The patentability with respect to certain limit(s) of independent claim 29 as claimed, this limit being:

*“at least four compression members that lie on the surfaces of two different planes that intersect one another”,*

has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, first

paragraph to start on page 7; and the last paragraph to start on page 14 and continuing onto page 15).

The patentability with respect to limit(s) added by dependent claim 34 (and of any limit added by claims 53, 54 and 55) has not been expressly urged before the Office and thus dependent claim 34 (and that “aspect” of each of multiply dependent claims 53, 54 and 55 that depends from claim 31) stand or fall with the independent claim from which they depend, claim 24, as presumed.

(f) Claim 32 depends from claim 31 but does not stand or fall with claim 31 because claim 32 adds the limit of an internal tension member configuration, whose patentability has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, page 13-14, paragraph (c), including the text on page 14 “This [internal tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose internal tension member configurations.”); see also, the publication of the instant originally filed application US 2002/0002807 A1, page 2, paragraph [0029], which refers to a 6 strut planar self-guyed structure with an internal guy (tension member) arrangement and which states in part that the internal guy arrangement “...also can be used to reduce the total length of guy members necessary to provide structural integrity to the icosahedron or to achieve other design goals”; see also,

(g) Claim 33 depends from claim 31 but does not stand or fall with claim 31 because claim 33 adds the limit of a radial tension member configuration, whose patentability has been separately and expressly urged before the Office (see, e.g., the publication of the instant originally filed application US 2002/0002807 A1, page 2, paragraph [0028], which refers to a 6 strut planar self-guyed structure with a radial arrangement of guys and which states in part “This radial configuration represents the minimal total length of guy members for the case of the icosahedron with guys on an edge or in the face planes. The radial configuration requires only 60% of the length required with the circumferential arrangement of Fig. 1B.”); see also, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, page 12-13, paragraph (b), including the text on page 13 “This [radial tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose radial tension member configurations.”)

h) Claims 35, 38, 53\*, 54\* and 55\* stand or fall together. The patentability with respect to certain limits of independent claim 35 as claimed, these limits being:

*“a first set of at least two compression members situated on the surface of a first hyperbolic paraboloid;*

*“a second set of at least two compression members situated on the surface of a second hyperbolic paraboloid”,*

has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, second paragraph to start on page 7; and page 15, paragraph (e)).

The patentability with respect to any limit added by dependent claim 38 (and of any limit added by claims 53, 54 and 55) has not been expressly urged before the Office and thus dependent claim 38 (and that “aspect” of each of multiply dependent claims 53, 54 and 55 that depends from claim 35) stand or fall with the independent claim from which they depend, claim 35, as presumed.

(i, j) Each of claims 36 and 37 stands or falls by itself, as each claim is not grouped with any other claim. Claim 36 depends from claim 35 but does not stand or fall with claim 35 because claim 36 adds the limit of an internal tension member configuration, whose patentability has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, page 13-14, paragraph (c), including the text on page 14 “This [internal tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose internal tension member configurations.”). Claim 37 depends from claim 35 but does not stand or fall with claim 35 because claim 37 adds the limit of a radial tension member configuration, whose patentability has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, page 12-13, paragraph (b), including the text on page 13 “This [radial tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose radial tension member configurations.”).

k) Claims 43, 46, 53\*, 54\* and 55\* stand or fall together. The patentability with respect to certain limits of independent claim 35 as claimed, these limits being:

*“an outer set of at least six tension members that connects said at least four compression members with one another at outer tension member attachments; and*

*an inner set of at least four tension members that connects said at least four compression members with one another at inner tension member attachments,*

*wherein said inner tension member attachments and said outer tension member attachments are disposed on said at least four compression members,*

*wherein said outer tension member attachments define an outer enclosing surface that has only polygonal faces, and*

*wherein said inner tension member attachments are disposed within said outer enclosing surface”,*

has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, first paragraph to start on page 8; and page 15, paragraph (g)).

The patentability with respect to the limit added by dependent claim 46 (and of any limit added by claims 53, 54 and 55) has not been expressly urged before the Office and thus dependent claim 46 (and that “aspect” of each of multiply dependent claims 53, 54 and 55 that depends from claim 43) stand or fall with the independent claim from which they depend, claim 43, as presumed.

(l, m) Each of claims 44-45 stands or falls by itself, as each claim is not grouped with any other claim. Claim 44 depends from claim 43 but does not stand or fall with claim 43 because claim 44 adds the limit of an internal tension member configuration, whose patentability has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, page 13-14, paragraph (c), including the text on page 14 “This [internal tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose internal tension member configurations.”). Claim 45 depends from claim 43 but does not stand or fall with claim 43 because claim 45 adds the limit of a radial tension member configuration, whose patentability has been separately and expressly urged before the Office (see, e.g., the publication of the instant originally filed application US 2002/0002807 A1, page 2, paragraph [0036], which describes a 6 strut (compression member) polygonal self-guyed structure with certain guys (tension members) arranged in a radial configuration, and states, in part, that “This radial configuration of guys requires only 58% of the length required in the circumferential arrangement.”; see also, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, page 12-13, paragraph (b), including the text on page 13 “This [radial tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose radial tension member configurations.”)

n) Claims 47, 53\*, 54\* and 55\* stand or fall together. The patentability with respect to certain limit(s) of independent claim 47 as claimed, this limit being:

*“wherein at least three of said at least six tension members are arranged in a radial configuration”,*

has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, first paragraph to start on page 6; and pages 12-13, paragraph (b)).

Claim 47 has no dependent claims other than the indicated claims 53, 54 and 55. The patentability of any limit added by each of dependent claims 53, 54 and 55 has not been expressly urged before the Office and thus that “aspect” of each of multiply dependent claims 53, 54 and 55 that depends from claim 47 stands or falls with the independent claim from which it depends, claim 47, as presumed.

o) Claims 48, 53\*, 54\* and 55\* stand or fall together. The patentability with respect to certain limit(s) of independent claim 48 as claimed, this limit being:

*"wherein at least one of said tension members is arranged in an internal configuration"*

has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, first paragraph to start on page 6; and pages 13-14, paragraph (c)).

Claim 48 has no dependent claims other than the indicated claims 53, 54 and 55. The patentability of any limit added by each of dependent claims 53, 54 and 55 has not been expressly urged before the Office and thus that "aspect" of each of multiply dependent claims 53, 54 and 55 that depends from claim 48 stands or falls with the independent claim from which it depends, claim 48, as presumed.

p) Claims 49, 52, 53\*, 54\* and 55\* stand or fall together. The patentability with respect to certain limit(s) of independent claim 49 as claimed, these limits being:

*"wherein at least two of said at least three compression members are situated on the surface of a first hyperboloid of revolution of one sheet;*

*wherein at least one other compression member of said at least three compression members is situated on the surface of at least a second hyperboloid of revolution of one sheet",*

has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, last paragraph to start on page 5).

The patentability of the limit added by dependent claim 52 (and of any limit added by claims 53, 54 and 55) has not been expressly urged before the Office and thus dependent claim 49 (and that "aspect" of each of multiply dependent claims 53, 54 and 55 that depends from claim 49) stand or fall with the independent claim from which they depend, claim 49, as presumed.

(q, r) Each of claims 50 and 51 stands or falls by itself, as each claim is not grouped with any other claim. Claim 50 depends from claim 49 but does not stand or fall with claim 49 because claim 50 adds the limit of an "internal tension member configuration", whose patentability has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, page 13-14, paragraph (c), including the text on page 14 "This [internal tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose internal tension member configurations.") Claim 51 depends from claim 49 but does not stand or fall with claim

49 because claim 51 adds the limit of a “radial tension member configuration”, whose patentability has been separately and expressly urged before the Office (see, Amendment and Request for Reconsideration Under 37 C.F.R. § 1.111, submitted December 2, 2002, page 12-13, paragraph (b), including the text on page 13 “This [radial tension member] arrangement has significant strength benefits as compared with structures such as Skelton that do not disclose radial tension member configurations.”).

\* Claims 53, 54 and 55 are each multiply dependent claims that each depend in the alternative from every independent claim remaining in the case (claims 20, 24, 29, 30, 31, 35, 39, 43, 37, 48 and 49); only that aspect of each of claims 53-55 that depends from a particular independent claim stands or falls with the independent claim in the same group. Hence, the asterisk presented alongside each of claims 53, 54 and 55 above indicates that only that aspect of the multiply dependent claim 53, 54 or 55 that depends from the specific independent claim with which it is grouped is to be included in that grouping.

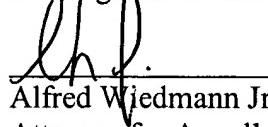
## XI. Conclusion

For the foregoing reasons, it is submitted the Examiner’s rejections of the claims remaining in the case after entry of the Amendment Under 37 C.F.R. 1.116 submitted herewith – those remaining claims being claims 20-38, and 43-55 – is erroneous, and reversal of his decisions is respectfully requested.

Dated this 9<sup>th</sup> day of December, 2003.

Respectfully Submitted:

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## **APPENDIX**

### **CLEAN VERSION OF CLAIMS AS AMENDED**

Claims 1-19 (canceled)

20. A three-dimensional structure comprising:

at least three compression members situated on the surface of a first hyperboloid of revolution of one sheet having a mid-plane that is perpendicular to the conjugate axis of said first hyperboloid, wherein each said at least three compression members includes:

- a first portion located on the surface of said first hyperboloid on one side of the mid-plane of said first hyperboloid; and
- a second portion located on the surface of said first hyperboloid on the other, second side of the mid-plane of said first hyperboloid;

a first set of at least three tension members that connect said first compression member portions with one another;

a second set of at least three tension members that connect said second compression member portions with one another; and

a third set of at least three tension members that each connects at least one of said first compression member portions with at least one of said second compression member portions of a different compression member,

wherein at least three tension members are configured in a radial configuration.

21. A three-dimensional structure as described in claim 20 wherein said at least three tension members configured in a radial configuration are of said first set of at least three tension members.
22. A three-dimensional structure as described in claim 20 wherein said at least three tension members configured in a radial configuration are of said second set of at least three tension members.
23. A three-dimensional structure as described in claim 20 wherein said third set of at least three tension members is situated on the surface of a second hyperboloid of revolution of one sheet.
24. A three-dimensional structure comprising:

at least three compression members situated on the surface of a first hyperboloid of revolution of one sheet having a mid-plane that is perpendicular to the conjugate axis of said first hyperboloid, wherein each said at least three compression members includes:

- a first portion located on the surface of said first hyperboloid on one side of the mid-plane of said first hyperboloid; and
- a second portion located on the surface of said first hyperboloid on the other, second side of the mid-plane of said first hyperboloid;

a first set of at least three tension members that connects said first compression member portions with one another;

a second set of at least three tension members that connects said second compression member portions with one another; and

a third set of at least three tension members that each connects at least one of said first compression member portions with at least one of said second compression member portions of a different compression member,

wherein at least one tension member is configured in an internal configuration.

25. A three-dimensional structure as described in claim 24 wherein said at least one tension members configured in an internal configuration is of said first set of at least three tension members.
26. A three-dimensional structure as described in claim 24 wherein said at least one tension members configured in an internal configuration is of said second set of at least three tension members.
27. A three-dimensional structure as described in claim 24 wherein said at least one tension members configured in an internal configuration is of said first third of at least three tension members.
28. A three-dimensional structure as described in claim 24 wherein said third set of at least three tension members is situated on the surface of a second hyperboloid of revolution of one sheet.
29. A three-dimensional structure comprising:  
at least three compression members that each lie on the surface of one of at least three different planes that intersect one another; and

a set of at least six tension members that connects each of said at least three compression members with at least one other compression member of said at least three compression members,

wherein at least three tension members of said set of at least six tension members are arranged in a radial configuration.

30. A three-dimensional structure comprising:

at least three compression members that each lie on the surface of one of at least three different planes that intersect one another; and

a set of at least six tension members that connects each of said at least three compression members with at least one other compression member of said at least three compression members,

wherein at least one tension member of said set of at least six tension members is arranged in an internal configuration.

31. A three-dimensional structure comprising:

at least four compression members that lie on the surfaces of two different planes that intersect one another; and

a set of at least six tension members that connects each of said at least four compression members with at least one other compression member of said at least four compression members.

32. A three-dimensional structure as described in claim 31 wherein at least one tension member is arranged in an internal configuration.
33. A three-dimensional structure as described in claim 31 wherein at least three tension members are arranged in a radial configuration.
34. A three-dimensional structure as described in claim 31 wherein at least one tension member is arranged in a circumferential configuration.
35. A three-dimensional structure comprising:
  - a first set of at least two compression members situated on the surface of a first hyperbolic paraboloid;
  - a second set of at least two compression members situated on the surface of a second hyperbolic paraboloid; and

a set of at least twelve tension members which connect said compression members with one another,

wherein said second hyperbolic paraboloid surface intersects said first hyperbolic paraboloid surface.

36. A three-dimensional structure as described in claim 35 wherein at least one of said at least twelve tension members is arranged in an internal configuration.
37. A three-dimensional structure as described in claim 35 wherein at least three of said set of at least twelve tension members are arranged in a radial configuration.
38. A three-dimensional structure as described in claim 35 wherein at least one of said set of at least twelve tension members is arranged in a circumferential configuration.

Claims 39 - 42 (canceled)

43. A three-dimensional structure comprising:

at least four compression members;

an outer set of at least six tension members that connects said at least four compression members with one another at outer tension member attachments; and

an inner set of at least four tension members that connects said at least four compression members with one another at inner tension member attachments,

wherein said inner tension member attachments and said outer tension member attachments are disposed on said at least four compression members,

wherein said outer tension member attachments define an outer enclosing surface that has only polygonal faces, and

wherein said inner tension member attachments are disposed within said outer enclosing surface.

44. A three-dimensional structure as described in claim 43 wherein at least one tension member is arranged in an internal configuration.
45. A three-dimensional structure as described in claim 43 wherein at least three tension members are arranged in a radial configuration
46. A three-dimensional structure as described in claim 43 wherein at least three tension members are arranged in a circumferential configuration.

47. A three-dimensional structure comprising:
- at least three compression members; and
- at least six tension members that connect said at least three compression members with one another,
- wherein at least three of said at least six tension members are arranged in a radial configuration.
48. A three-dimensional structure comprising:
- at least three compression members; and
- a set of at least six tension members that connect said at least three compression members with one another, and
- wherein at least one of said tension members is arranged in an internal configuration.

49. A three-dimensional structure comprising:

at least three compression members,

wherein at least two of said at least three compression members are situated on the surface of a first hyperboloid of revolution of one sheet;

wherein at least one other compression member of said at least three compression members is situated on the surface of at least a second hyperboloid of revolution of one sheet,

wherein each said hyperboloid of revolution of one sheet has a mid-plane that is perpendicular to the conjugate axis of the hyperboloid, and

wherein each said at least three compression members includes:

- a first portion situated on one side of the mid-plane of the hyperboloid upon which it is situated;

- a second portion situated on the other side of the mid-plane of the hyperboloid upon which it is situated;

a first set of at least three tension members that connect said first compression member portions with one another;

- a second set of at least three tension members that connect said second compression member portions with one another; and
- a third set of at least three tension members that each connect at least one of said first compression member portions with at least one of said second compression member portions of a different compression member.
50. A three-dimensional structure as described in claim 49 wherein at least one of said tension members is arranged in an internal configuration.
51. A three-dimensional structure as described in claim 49 wherein at least three of said tension members are arranged in a radial configuration.
52. A three-dimensional structure as described in claim 49 wherein at least one of said tension members are arranged in a circumferential configuration.
53. A three-dimensional structure as described in any one of claims 20, 24, 29, 30, 31, 35, 43, 47, 48, or 49 wherein each of said compression members is straight.
54. A three-dimensional structure as described in any one of claims 20, 24, 29, 30, 31, 35, 43, 47, 48 or 49 wherein each said tension members attaches ends of at least two compression members.

55. Compression members and tension members that are configurable to form the three-dimensional structure as described in any one of claims 20, 24, 29, 30, 31, 35, 43, 47, 48 or 49.